~~277~~
673

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH ADMINISTRATION
BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

Project	Date	Author

SUBJECT—

TITLE

SPRUCE BUDWORM IN OREGON AND WASHINGTON

Season of 1948

By

R. L. Furniss
W. J. Buckhorn
K. H. Wright

Forest Insect Laboratory
445 U. S. Court House
Portland 5, Oregon
November 1, 1948

INDEX No.—

U. S. GOVERNMENT PRINTING OFFICE 16—47272-1

THE SPRUCE BUDWORM IN OREGON AND WASHINGTON

Season of 1948

By

R. L. Furniss, W. J. Buckhorn, and K. H. Wright

445 U. S. Court House
Portland, Oregon
November 1, 1948

CONTENTS

	Page
INTRODUCTION	1
THE BUDWORM AND ITS HABITS	2
THE CURRENT OUTBREAK	2
History	2
Survey of 1948	3
Situation in the Blue Mountains	3
Malheur National Forest	3
Ochoco National Forest	4
Umatilla National Forest	4
Wallowa National Forest	5
Whitman National Forest	5
Situation in the Oregon Cascades	5
Mount Hood National Forest	6
Springfield Area	6
Situation on Other Areas	7
Chelan National Forest	7
Fremont National Forest	7
Snoqualmie National Forest	7
Wenatchee National Forest	7
CONTROL CONSIDERATIONS	7
RECOMMENDATIONS	8
TABLE NO. 1 -Intensity of infestation	
TABLE NO. 2 -Ownership of infested areas	
MAP NO. 1 - Blue Mountains area	
MAP NO. 2 - Oregon Cascades area	

INTRODUCTION

The spruce budworm, a major insect enemy of fir and spruce stands in much of North America, has in the past five years become widely epidemic in the forests of Oregon and Washington, particularly Oregon. The recorded extent of this outbreak is 1,432,000 acres. Douglas-fir and balsam-firs of all ages are being killed in the most heavily attacked stands. While no great loss of timber has yet occurred, continuation of the outbreak at its present high level will very likely result in heavy losses.

The purpose of this report is to record what is known of the outbreak and to discuss the possibilities of control. The data presented are based upon five years' observations of the outbreak, intensive surveys in 1947 and 1948, and an experimental control project and detailed biological studies in 1948. The work in 1948 was done cooperatively by the Bureau of Entomology and Plant Quarantine, the U. S. Forest Service, and the Oregon State Board of Forestry.

The situation at the end of the 1947 season, as reported by Buckhorn, 1/ pointed clearly to an impending need for reliable control measures. Since no proven measure was available, the cooperating agencies and the Kinzua Pine Mills Company decided to undertake a large-scale experiment to test the treatments that had given most promise over a period of years in the Eastern United States and Canada. The experiment was conducted in late June and early July on the Heppner Ranger District of the Umatilla National Forest. It was demonstrated that the aerial application of one pound of DDT in one gallon of fuel oil, when properly timed, gives upward of 95 percent control. Thus a tested and relatively economical control measure became available concurrently with the developing need.

An intensive study of the budworm was made throughout the 1948 season on the Heppner Ranger District and other representative areas in the Blue Mountains. The habits of the budworm were studied and records were kept on the degree of parasitism and the incidence of disease. Late in the season some observations were made on the Springfield area in Western Oregon. This biological work, which is basic to a sound control program, is as yet in the elementary stages. Much remains to be learned about the budworm in the Pacific Northwest, especially regarding the factors governing the rise and fall of outbreaks. So far as could be determined, the budworm population on all the principal areas of infestation went into the winter of 1948 in a vigorous condition.

1/ Buckhorn, W. J. - Defoliator situation in the fir stands of eastern Oregon and Washington, season of 1947. An office report dated February 18, 1948.

During August and September an intensive survey was made by aerial and ground methods. The findings of this survey are given area by area in a later section of this report. (See the accompanying tables and maps).

THE BUDWORM AND ITS HABITS

Before proceeding with the situation in Oregon and Washington it is well to consider the general nature of the budworm and what is known of its destructiveness. In the spruce-fir forests of the Northeastern and the Lake States and of Eastern Canada the spruce budworm undoubtedly is the major insect pest. Recurrent outbreaks in those areas have killed vast amounts of timber. In one outbreak in Minnesota as estimated 20,000,000 cords of balsam fir alone were killed. Elsewhere in even larger outbreaks no attempt was made to measure the loss.

In most of the Rocky Mountain States and in interior British Columbia the budworm is a serious pest of Douglas-fir and balsam firs, its attacks often being followed by bark beetle outbreaks. In Oregon and Washington it is little known. Until 1943 there were no recorded major outbreaks. Since then it has become and continues to be widely epidemic. In 1947 it was recorded for the first time in western Oregon.

The budworm adults are inconspicuous, mottled, buff-colored to greyish moths with a wing spread of about one inch. They are seldom noted except during mass flights such as occurred in 1948 when great numbers invaded such towns as Walla Walla, Wash., and La Grande and Huntington, Ore.

The eggs are laid in late July or early August on the needles of the host trees. They hatch in about 10 days and the minute larvae crawl to convenient hiding places on the twigs, branches, and trunks where they spin cocoons in which they hibernate until the following spring. In May they emerge and enter the old needles and later the expanding buds. During most of their developmental period they are well protected in the buds. It is only when the buds have expanded and the new growth elongated that the budworm larvae are exposed to insect enemies and the effects of spraying. This vulnerable period lasts only about ten days to two weeks, thus making the spraying period very critical. At maturity the larvae are greenish brown and approximately one inch long. They wriggle violently, backward or forward, and frequently drop on silken threads when disturbed. Pupation takes place in the webbed branchlets.

THE CURRENT OUTBREAK

History

The recorded outbreaks of the spruce budworm in Oregon and Washington are few. Small centers of infestation were noted in 1929 near Northport, Wash.; in 1931 south of Mitchell, Ore; and in 1941 and 1942 in the Warner Mountains south of Lakeview, Ore. The first outbreak of consequence developed in 1943 in the Methow Valley, Wash., and by 1947 had

spread over much of the Chelan National Forest and adjacent areas. This outbreak seems to have subsided in 1948 due to natural causes. In 1944 a light infestation of the budworm was found on the Heppner District of the Umatilla National Forest. Since then the outbreak has developed until now some 1,243,000 acres in the Blue Mountains are infested. In 1947 a small outbreak was discovered near Oakridge, Ore. By 1948 some 86,200 acres in this general vicinity had become infested. An outbreak of 102,790 acres was discovered on the eastern slopes of the Mount Hood National Forest in 1948.

Survey of 1948

The survey of 1948, as that of 1947, was in two parts, the detection or aerial reconnaissance phase and the ground checking phase. The aerial reconnaissance was done in several types of aircraft and consisted of sketch mapping the infestation in place. Some 43 hours were spent in the air covering 6,898,900 timbered acres in the Blue Mountains. An additional 22 flight hours were spent in covering 4,465,000 timbered acres extending from the northeastern part of the Mt. Hood to the northern part of the Umpqua National Forests. The boundaries and intensity of infestation were checked on the ground and an attempt was made through egg counts to evaluate next season's infestation. The ground checking required 47 man-days in the Blue Mountains and 28 man-days in the Cascades.

In 1948 the budworm could be found literally everywhere in the Blue Mountains. Only those stands with defoliation sufficient to detect from the air were recorded. This course was taken because the means were not at hand to delineate the areas of very light infestation. Accordingly, the total acreages given in this report are low.

Situation in the Blue Mountains

The budworm outbreak in the Blue Mountains is the most extensive in the region, comprising some 1,243,000 acres. Defoliation is rated as very heavy on 203,000 acres. On such areas tree mortality is in progress. An additional 256,300 acres are heavily defoliated. Tree mortality on these areas will develop in case heavy feeding continues next year.

Malheur National Forest In 1948 the budworm situation on the Malheur changed materially with some increases and some decreases. The over-all infestation in 1948 was 56,000 acres as compared with 41,000 acres in 1947. The Black Butte - Rudio Mountain area declined from 35,000 acres to 18,000 acres with the intensity remaining about constant. The infestation on the ridge north of Fox Valley likewise remained about the same intensity but decreased in area from 6000 to 4000 acres. A small area of light infestation along Rudio Creek in 1947 dropped out completely in 1948. In contrast with these decreases, a new area of 34,000 acres showed up in the Fox Creek - Long Creek drainages in 1948. Some 22,400 acres of this new infestation were of moderate intensity and the remainder were light. The forest-wide breakdown of budworm infestation in 1948 by intensity was as follows: light - 33,600 acres and moderate - 22,400 acres.

Most of the budworm-infested stands on the Malheur are of merchantable quality. Ownership is 65.9 percent federal, 32.4 percent private, and 1.7 percent state and county.

The opposed infestation trends on the Malheur leave the future of the outbreak on that area in considerable doubt. It is clear, however, that no tree mortality will result from the defoliation to date. It is probable that the affected stands can stand one and perhaps two more years of attacks without serious losses. No control is recommended for 1949.

Ochoco National Forest - In 1947 some 15,000 acres of spruce budworm infestation in two centers was present on the Snow Mountain District. This outbreak was comparatively light with no tree killing. In 1948 these two centers practically disappeared. No defoliation was evident from the air. Only after diligent search on the ground could any evidence of current feeding be found. No budworm control will be needed on the Ochoco in 1949.

Umatilla National Forest - The total budworm infestation in 1948 was 807,000 acres as compared with 374,000 acres in 1947, an increase of more than 100 percent in one year. The degree of infestation by acreages in 1948 was about as follows: light - 133,000, moderate - 282,000, heavy - 229,000, and very heavy - 163,000. Defoliation on the "very heavy" areas has reached the stage where tree mortality is occurring and much more is threatened in the near future. The trees on both the "heavy" and "very heavy" areas have been weakened sufficiently to make them especially subject to attacks of bark beetles, of which the Douglas-fir beetle, Dendroctonus pseudotsugae, probably is most important. The areas of heaviest defoliation are in the same general locations that they were in 1947, but they have increased considerably in size.

Predominantly the infestation on the northern part of the Umatilla area is in stands of low value due to the rugged terrain and in many cases the subalpine character of the timber. The Tollgate area is an exception in that it is an intensively used recreation area with the trees, mostly firs, being of high aesthetic value. On the southern part of the Umatilla area timber values of the infested fir are generally fair. Battle Mountain State Park is a heavily affected area of small size but considerable recreational value.

Ownership on the Umatilla area is nearly equally divided with 51.7 percent of the infested acreage being federally controlled. The remaining 48.3 percent is largely privately owned.

Control on the Umatilla is largely a problem of finding a place to begin and a place to end. Infestations is so widely and generally distributed that the most feasible approach is to apply control on a value rather than an entomological basis. This approach involves considerable risk of re-infestation from surrounding untreated areas but might prove successful on an annual maintenance basis while the outbreak continues. Whether it is practical under the Oregon forest laws is a question that can not be answered here.

Wallowa National Forest - In 1947 the total infested acreage on and adjacent to the Wallowa was 150,000. In 1948 this increased to 227,000 acres divided about as follows: light - 25,000, moderate - 197,500, and heavy - 4,500. Most of the increase occurred on the southern part of the forest in low value stands where several small spots that were present in 1947 expanded and merged. The Chesnimnus block of infestation remained approximately the same, both as to size and intensity. The Day Ridge block expanded somewhat.

No appreciable kill is anticipated from the defoliation that has occurred to date. Even the Douglas-fir beetle which was epidemic in 1946, has not attacked the budworm-infested trees to any noticeable extent. No control of the budworm on the Wallowa is proposed at this time.

Ownership of the budworm-infested areas on the Wallowa is 61.0. percent federal, 34.6 percent private, and 4.4 percent state and county.

Whitman National Forest - On the Blue Mountain Division of the Whitman the extent and intensity of infestation was the same in 1947 and 1948. There was a total of 43,000 infested acres divided as follows: light - 29,600, moderate-9,600, and heavy - 3,800. No tree mortality is expected from the defoliation to date. No control seems necessary at this time.

On the Minam Division an infestation of 87,000 acres in 1947 increased to 110,000 acres in 1948. The breakdown of acreage by degree of infestation in 1948 was: light - 28,000, moderate - 23,000, heavy - 19,000, and very heavy - 40,000. The increase on this division is accounted for by a new area of 28,000 acres of generally light infestation that showed up in 1948 in the Clark Creek and Indian Creek drainages.

Considerable killing can be expected from the defoliation that has occurred to date in the Clark Mountain and Catherine Creek centers. The Catherine Creek and Clark Mountain areas present good possibilities for successful control because they are fairly well isolated from other infestations and are accessible for control operations. The drawback is that the stands, being largely logged, are of low volume and little current value. Thus protection would be afforded principally to young growth and scattered reserve trees.

Ownership of the infested areas on the Whitman is 43.6 percent federal, 55.5 percent private, and 0.9 percent state and county.

Situation in the Oregon Cascades

The budworm outbreak in the Oregon Cascades, so far as is known, is confined to the eastern slopes of the Mount Hood and to one large and several small areas in the vicinity of Springfield, Ore. Infestation is of recent origin. While no mortality has yet occurred, continued heavy feeding in 1949 will very likely result in timber losses. The special significance of these outbreaks, particularly the one at Springfield, is that they are in stands of moderate to high value. Also they are a direct threat to other valuable stands in the Douglas-fir region proper.

Mt. Hood National Forest - The budworm was first reported on the Mount Hood during the summer of 1948. Subsequent intensive scouting revealed some 102,790 acres of infestation on the eastern slopes of the forest. The degree of infestation by acreages was as follows: light - 68,980, moderate - 28,160, and heavy - 5,650.

Since this is a new outbreak, it is probable that the timber will survive another year of defoliation without excessive kill. By then, however, the outbreak will have had an opportunity to spread and the problem of ultimate control may be much greater. Because of this likelihood and the value of the threatened timber it seems desirable to consider control at this time. Some of the favorable features for control on the Mt. Hood area are that the infestation is well isolated, the terrain is not excessively broken, the area is fairly accessible, and the infestation is in one large block.

The ownership of the presently infested stands on the Mount Hood area is 70.3 percent federal, 29.0 percent private, and 0.7 percent state.

Springfield area - In 1947 a small infestation was reported near Oakridge, Ore. In 1948 this center expanded and a much larger one was discovered between Springfield and Lebanon. An intensive survey disclosed 5 additional areas of infestation in this general vicinity. Altogether the infestation on what has been designated as the Springfield area totals 86,200 acres with the intensity distributed as follows: light - 26,030 acres, moderate - 43,790 acres, and heavy - 16,380 acres.

Predominantly the infestation is in high-value stands of advanced second growth. Some old-growth and some pole stands are also infested. Ownership of the infested timber is 79.2 percent private, 15.3 percent National forest, 4.5 O and C, and 1.0 percent county.

Probably the first appreciable defoliation on the Springfield area developed in 1947, but certainly the bulk of it occurred in 1948. No tree mortality is expected from the defoliation to date. Another year of heavy feeding by the budworm will likely lead to considerable mortality on the areas now designated as "heavy".

This is the first recorded outbreak of the budworm in typical west-side Douglas-fir stands of Oregon or Washington. It is of particular significance because of the high values involved and because of possible spread to other stands in the Douglas-fir region proper. Rather than gamble on the chance that the outbreak will subside before attaining greater proportions and before causing excessive damage, it is recommended that control be undertaken in 1949. It is further recommended that this project be given first priority in any budworm control program that may be undertaken in Oregon or Washington.

Situation on Other Areas

Four areas on which the budworm is not now actively epidemic are briefly discussed in this section to round out the region-wide record of recent infestations and to supplement Buckhorn's report already cited.

Chelan National Forest - No special survey of the outbreak on and adjacent to the Chelan was made in 1948. On August 11, 1948, the forest supervisor reported no budworm infestation; whereas, in 1947 damage was evident over much of the forest. Thus it appears that this outbreak which was first noted in 1943 ran its natural course in about five years. Not much direct killing resulted. It is not known how much secondary killing by bark beetles occurred but it is not believed to be great.

Fremont National Forest - A rather extensive outbreak of the spruce budworm was reported in 1947 on the Bly Ranger District. Subsequent checking later in the fall revealed that the damage was caused by frost rather than insects. No outbreak of the budworm is known to exist on the Fremont at the present time.

Snoqualmie National Forest - In 1947 rather vague reports indicated that the budworm might be present in the eastside stands on the Snoqualmie. These reports were never verified. On August 12, 1948, the forest supervisor reported no current budworm infestation.

Wenatchee National Forest - In 1947 several small spots of defoliator infestation were reported. It is not known whether the spruce budworm was involved, but it is considered likely because of the prevalence of the then current infestation on the adjoining Chelan. On August 12, 1948, the forest supervisor reported no known infestation by the budworm on the Wenatchee.

CONTROL CONSIDERATIONS

Control of the spruce budworm is not a simple matter. To begin with, it is difficult to determine exactly when, or if, control is necessary. That means forecasting what the budworm will do next season and the seasons thereafter. Unfortunately the budworm does not seem to have any fixed pattern when it comes to the duration and intensity of outbreaks. Many outbreaks subside without causing much damage; others are extremely destructive. Once an outbreak has reached the killing level, the safest course is to take action, other conditions warranting.

One treatment may not be enough, for the budworm at times has a long infestation cycle, as compared with such short-cycle species as the hemlock looper and the Douglas-fir tussock moth. This possibility, that repeated treatments may be necessary, emphasizes that the protected stands should be of sufficient value to warrant protection.

In the Blue Mountains the budworm has reached the killing stage on numerous large areas. Unfortunately these areas and the less heavily infested areas around them are so extensive that they exceed the practical limits of control many times over. Furthermore, there is the question of whether the stands are valuable enough to warrant control. If control is decided

upon, the only feasible approach at this stage is to select the most seriously affected stands of greatest value and give spot protection. Such a program can be expanded over a period of years, if the outbreak continues.

In the Oregon Cascades two large centers of budworm infestation exist. These have not yet reached the killing stage but they are expected to do so next year. By then these outbreaks are likely to have expanded greatly thus making the control problem much greater than it is now. Because of the value of the affected stands and the threat of spread to other high-value stands, it is considered desirable to initiate control in the spring of 1949. Such control cannot be expected to exterminate the budworm, but it is hoped that it will so reduce the population that the budworm will be checked until natural control takes over.

As a result of the highly successful experiment conducted on the Heppner District of the Umatilla National Forest in the spring of 1948, a tested and very effective control measure is available to combat the budworm. This consists of the aerial application of one pound of DDT in one gallon of fuel oil per acre.

The principal factors that must be fully considered in organizing a control program are: (1) the habits of the budworm limit effective spraying to a ten-day to two-week period; (2) the amount of suitable spraying equipment that can be obtained through qualified contractors is limited; and (3) the technical and administrative organization of large-scale, short-term control projects has practical limitations which will govern the success or failure of control.

Costs of any control work that is undertaken will be governed by the size of the project and the local conditions. Recent quotations on materials and services that would be needed indicate an approximate cost of $2.00 per acre for projects such as are considered in this report.

RECOMMENDATIONS

The following recommendations are a summary of what has been proposed in more detail in the preceding text. It is proposed:

1. That control work against the budworm in 1949 be limited to one project up to about 100,000 acres, or at most to two large projects;

2. That control on the Springfield area in western Oregon be given first priority;

3. That control on the eastern slopes of the Mount Hood National Forest be given second priority;

4. That conditions in the Blue Mountains be further discussed before a final decision is made for or against control;

5. That studies of the budworm in the Pacific Northwest be intensified in order to improve preventive and control methods;

6. That detection surveys along the lines developed in 1947 and 1948 be continued in 1949 and that special consideration be given to the optimum timing of the aerial reconnaissance.

TABLE NO. 1

SUMMARY OF SPRUCE BUDWORM SITUATION BY INTENSITY OF INFESTATION - SEASON OF 1948

Locality	INTENSITY OF INFESTATION									
	Light		Moderate		Heavy		Very Heavy		Total	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
BLUE MOUNTAINS										
Malheur N. F.	33,600	60.0	22,400	40.0					56,000	100
Umatilla N. F.	133,000	16.5	282,000	33.1	229.000	28.4	163,000	22.0	807,000	100
Wallowa N. F.	25,000	11.0	197,500	87.1	4,500	1.9			227,000	100
Whitman N. F.	57,600	37.7	32,600	21.3	22,800	14.9	40,000	26.1	153,000	
Subtotal	249,200	20.0	534,500	42.9	256,300	20.7	203,000	16.4	1,243,000	100
OREGON CASCADES										
Mt. Hood N. F.	68,980	67.1	28,160	27.4	5,650	5.5			102,790	100
Springfield	26,030	30.2	43,790	50.8	16,380	19.0			86,200	100
Subtotal	95,010	50.3	71,950	38.1	22,030	11.6			188,990	100
TOTAL	344,210	24.0	606,450	42.4	278,330	19.4	203,000	14.2	1,431.990	100

TABLE NO. 2

SUMMARY OF SPRUCE BUDWORM SITUATION BY OWNERSHIP CLASSES - SEASON OF 1948

PART I - BLUE MOUNTAINS

	Ownership									
	Federal		State		County		Private		Total	
Locality	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Malheur N. F.	36,920	65.9	40	0.1	880	1.6	18,160	32.4	56,000	100
Umatilla N. F.	417,040	51.7	7,800	0.9	11,900	1.5	370,260	45.9	807,000	100
Wallowa N. F.	138,330	61.0	1,950	0.9	8,000	3.5	78,720	34.6	227,000	100
Whitman N. F.	66,740	43.6	240	0.2	1.060	0.7	84,960	55.5	153,000	100
TOTAL	659,030	53.0	10,030	0.8	21,840	1.8	552,100	44.4	1,243,000	100

PART II - OREGON CASCADES

	Ownership											
	National Forest		O and C		State		County		Private		Total	
Locality	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Mt. Hood N. R.	72,250	70.3			640	0.7			29,900	29.0	102,790	100
Springfield Area	3,740	4.4	13,240	15.4			890	1.0	68,330	79.2	86,200	100
TOTAL	75,990	40.3	13,240	7.0	640	0.3	890	0.5	98,230	51.9	188,990	100

AREAS of SPRUCE BUDWORM DEFOLIATION

1947

1948
- Light
- Medium
- Heavy
- Very Heavy

SCALE 1 INCH = 12 MILES

Map No. 1

Blue Mountains Area

AREAS of SPRUCE BUDWORM DEFOLIATION SEASON OF 1948

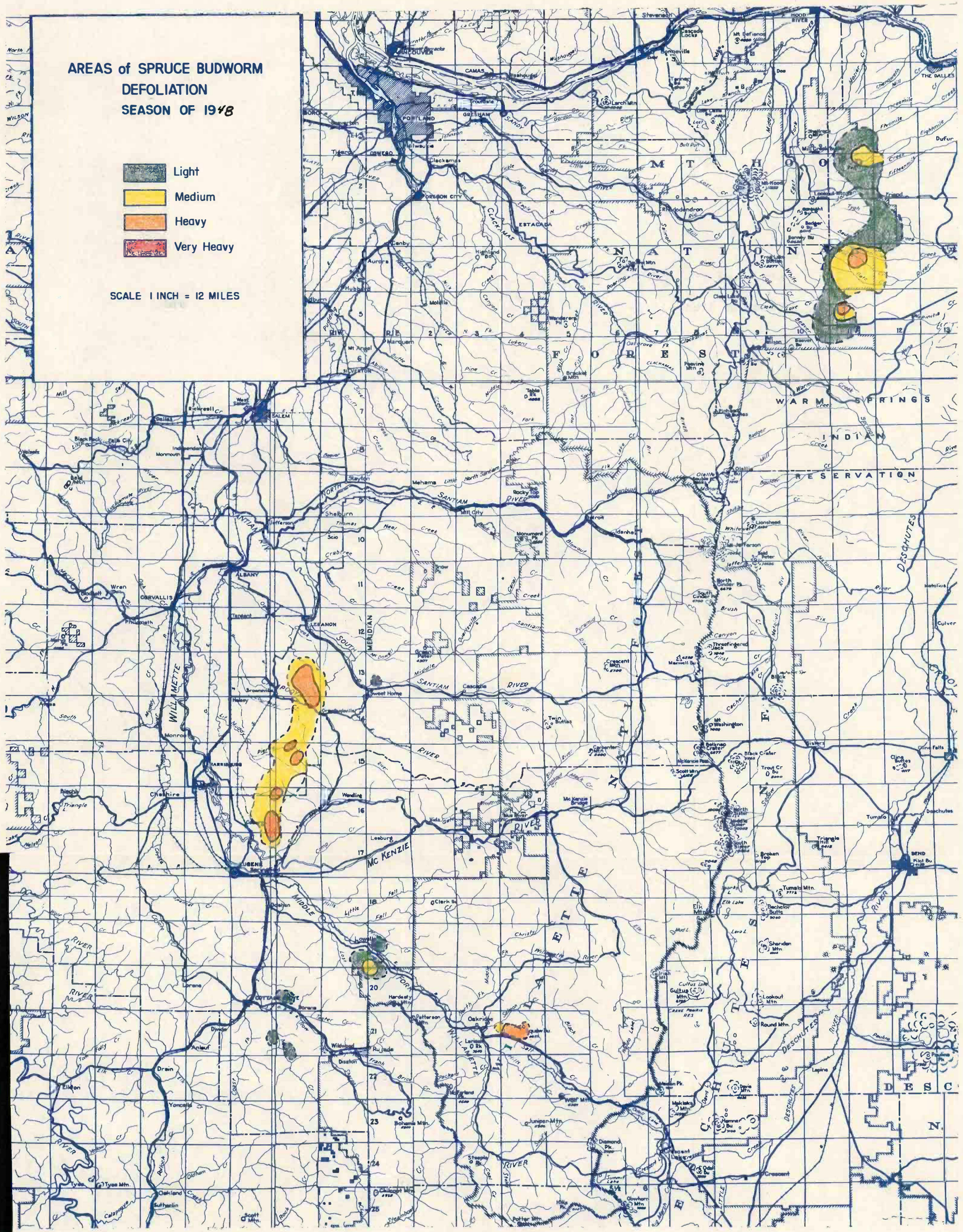
Light

Medium

Heavy

Very Heavy

SCALE 1 INCH = 12 MILES



Map No. 2

Oregon Cascades Area